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Thermo-elastic analysis of axially functionally graded rotating thick truncated conical shells with varying thickness

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ABSTRACT

In this paper, distributions of stress and displacement components of rotating truncated conical shells with varying thickness made of functionally graded materials (FGMs) subjected to thermo-mechanical loading are obtained. The materials are assumed to be perfectly elastic and isotropic which are assumed to vary according to the power law function in the axial direction of the conical shell. Based on steady-state heat conduction equation, the higher-order shear deformation theory (HSDT) is used to describe the nature of thermo-elastic behavior of the truncated conical shells. The system of partial differential equations is semi-analytically solved by using multi-layered method (MLM). Numerical results are presented to verify the accuracy of present theory and the influences played by many parameters are investigated.

Key words:

B. Elasticity

B. Thermomechanical

C. Analytical modelling

D. Thermal analysis

1. Introduction

Functionally graded materials (FGMs) are a new generation of novel composite materials in the family of engineering composites [1]. This composition ensures that some superior properties like overcoming interface problems and providing high thermal resistant and mechanical strength which make FGM structures an important subject for engineering applications [2-4].

Shell type structures are considered as promising candidates for various modern engineering applications such as aerospace and marine industries [5]. Since in most applications, shells must operate under extremes of thermal and mechanical loadings, any failure or fracture will be an irreparable disaster. So, adequate strength consideration is so important for these components. Functionally graded (FG) shells involving conical shells, in recent years, are widely used in space vehicles, aircrafts, nuclear power plants and many other engineering applications [6-8].